Pre-calculus: Vector problems

An airplane has a velocity of 400 m.p.h. in a southwest direction. A 50 m.p.h. wind is blowing from the west. Find the resultant speed and bearing of the plane. Round all intermediate calculations to six decimal places & all final answers to nearest thousandth.

\[ C^2 = 400^2 + 50^2 - 2(400)(50) \cos 45^\circ \]
\[ C \approx 366.354649 \]

Resultant speed 366.355 m.p.h.

\[ \frac{\sin 45}{366.354649} = \frac{\sin \Theta}{50} \]
\[ \sin^{-1} \frac{50 \sin 45}{366.354649} = \Theta \]
\[ \theta \approx 5.538^\circ \]

225 - 5.538 \approx 219.462^\circ \text{ resultant bearing}
Airplane's engine speed is 450 m.p.h. The flight plan requires the plane to fly due east. There is a 65 mph wind with a bearing of 60\(^\circ\) (blowing in a 60\(^\circ\) direction).

a) What bearing (direction) should the pilot take (aim the plane) in order to execute the flight plan?

b) What will the plane's actual air speed be?

\[
\sin 30^\circ = \frac{\sin \theta}{65} \quad \Rightarrow \quad \sin^{-1} \left( \frac{65 \sin 30^\circ}{450} \right) = m \angle \theta
\]

a) \(90^\circ + 4.142^\circ \approx 94.142^\circ \quad 4.142^\circ \approx m \angle \theta\)

b) \(\sin 145.858^\circ = \frac{\sin 30^\circ}{450} \approx C = 65^2 + 450^2 - 2(65)(450)\cos 145.858^\circ \quad \Rightarrow \quad C \approx 505.117\) mph

c) What is the horizontal component of the wind? 
\(65 \cos 30^\circ \approx 56.292\) mph (easterly)

d) What is the vertical component of the wind? 
\(65 \sin 30^\circ \approx 32.5\) mph (northerly)